VACET

SciDAC VISUALIZATION AND ANALYTICS CENTER FOR ENABLING TECHNOLOGY

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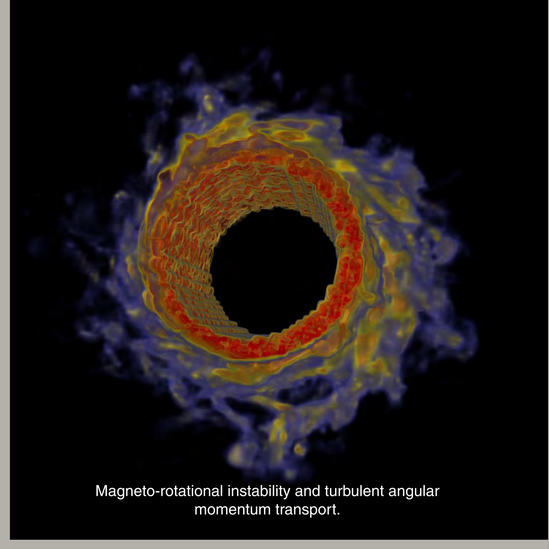

Magneto-rotational instability and turbulent angular momentum transport.

The Visualization and Analytics Center for Enabling Technologies (VACET) focuses on leveraging scientific visualization and analytics software technology as an enabling technology for increasing scientific productivity and insight. Advances in computational technology have resulted in an "information big bang," which in turn has created a significant data understanding challenge. This challenge is widely acknowledged to be one of the primary bottlenecks in contemporary science. Using an organizational model such as VACET, we are well positioned to respond to the needs of a diverse set of scientific stakeholders in a coordinated fashion using a range of visualization, mathematics, statistics, computer and computational science and data management technologies. The vision of VACET is to adapt, extend, create when necessary, and deploy visual data analysis solutions that are responsive to the needs of DOE's computational and experimental scientists. Our center is engineered to be directly responsive to those needs and to deliver solutions for use in DOE's large open computing facilities. The research and development directly target data understanding problems provided by our scientific application stakeholders. VACET draws from a diverse set of visualization technology ranging from production quality applications and application frameworks to state-of-the-art algorithms for visualization, analysis, analytics, data manipulation, and data management. Our goal is to respond to the urgent needs of the scientific community by providing significant, production-quality technology to aid in data understanding.

Techniques

Applications	Technical Point of Contact	Visualization: Integration of Basic Tools for Visualization and Analysis	Visualization: Publication Quality Images, Illustrations, and Movies	Visualization: Project-Wide Visualization Tools	Visualization: Flow Techniques	Visualization: Scalable Tools	Visualization: Remote Data Access and Streaming Techniques	Visualization: Collaborative Tools	Analytics: Query Driven Visualization	Analytics: Statistical Displays	Analytics: Feature Detection (topological analysis, semantic range queries)	Analytics: Temporal specific issues (feature tracking, events, ...)	Analytics: Multiple Fields	Analytics: Comparative Visualization and Analytics	Analytics: Uncertainty Visualization
Fusion	Utah ORNL LBNL	●●	●		●	●		●●	●●●	●●●	●●	●●●	●●●	●●●	●
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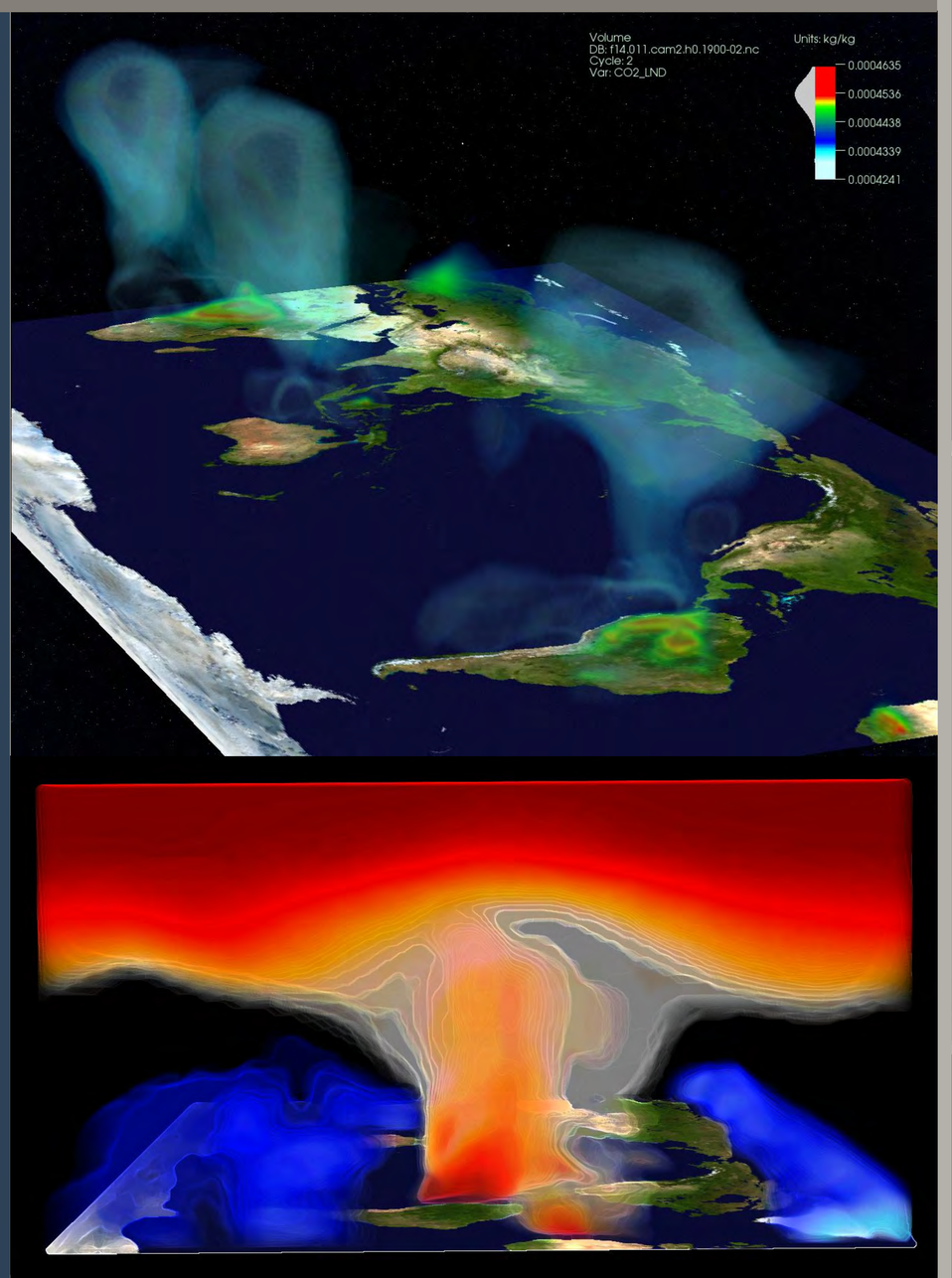
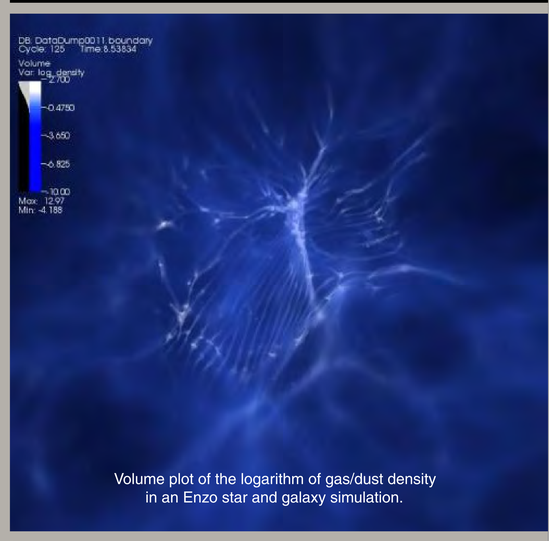
Astrophysics	ORNL LBNL	●	●●	●	●	●●	●●		●●●	●●	●●	●●	●●●	●●	●
Turbulence	LLNL	●	●●●		●	●●●	●●			●	●●●	●●●	●	●	
Climate	LLNL ORNL	●			●	●●	●●		●●●	●●	●●	●●	●●	●●	●●
Environmental Management	LBNL	●	●●	●●		●●●	●●●	●●							



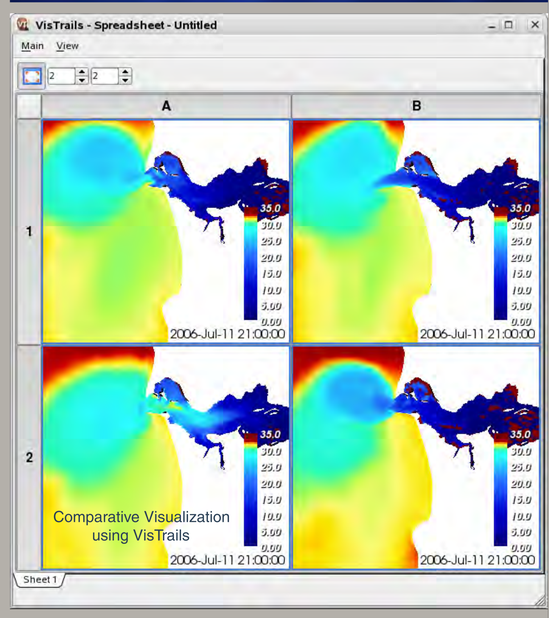
Climate visualization

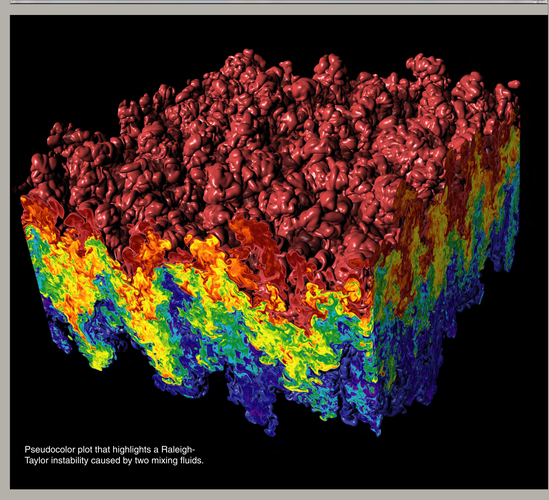
Carbon dioxide from various sources that are advected individually as tracers in the atmosphere model. Carbon dioxide from the ocean is shown as plumes during Feb. 1900.

Image courtesy of Forrest Hoffman and Jamison Daniel of Oak Ridge National Laboratory.

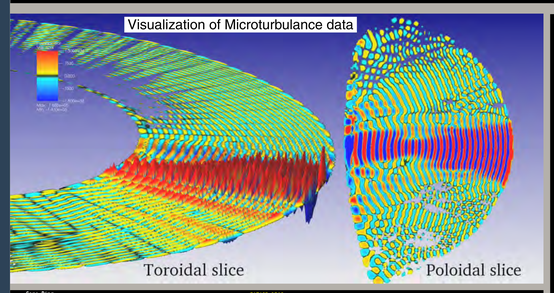


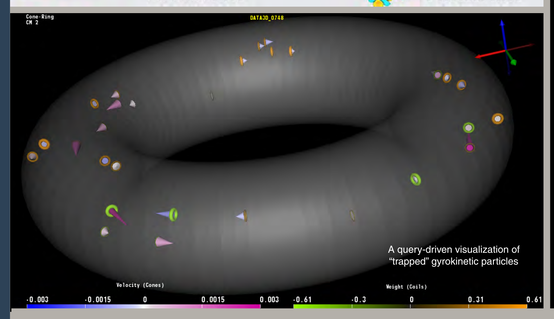
Volume plot of the logarithm of gas/dust density in an Enzo star and galaxy simulation.

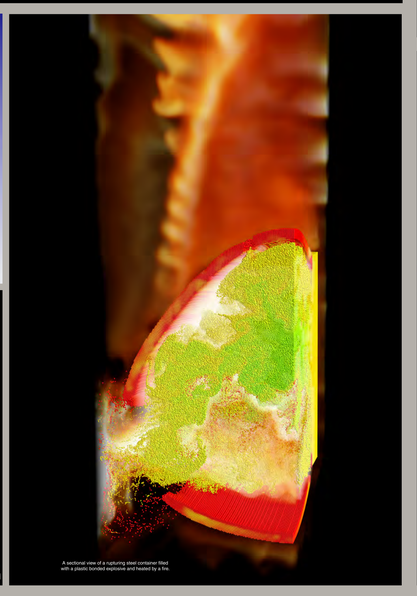


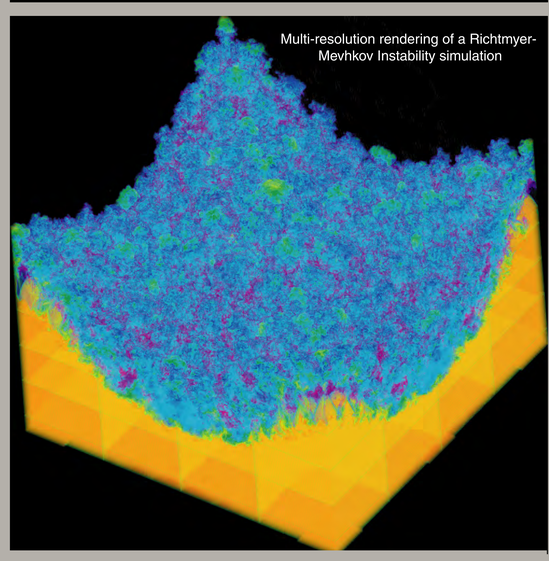


Pseudocolor plot that highlights a Raleigh-Taylor instability caused by two mixing fluids.









Our main goal is to develop and deploy a variety of data analysis and visualization tools for our science stakeholders. They have diverse data understanding needs, use a variety of computing resources, and are geographically distributed. Additionally, we want to leverage solutions developed and deployed for one stakeholder to many other projects. We address these challenges by using a flexible approach to software development and project management that draws from the diverse strengths of our team. Based upon specific input from science stakeholders – which include the fields of climate modeling, fusion, combustion chemistry, astrophysics and environmental management – we group their needs into two main categories: (1) visualization techniques, ranging from classical rendering techniques to the most advanced data streaming and remote data access algorithms for managing extremely large datasets, and (2) analytics techniques, including data exploration, feature extraction, tracking and comparison that aid the scientist in the actual information discovery process.

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